

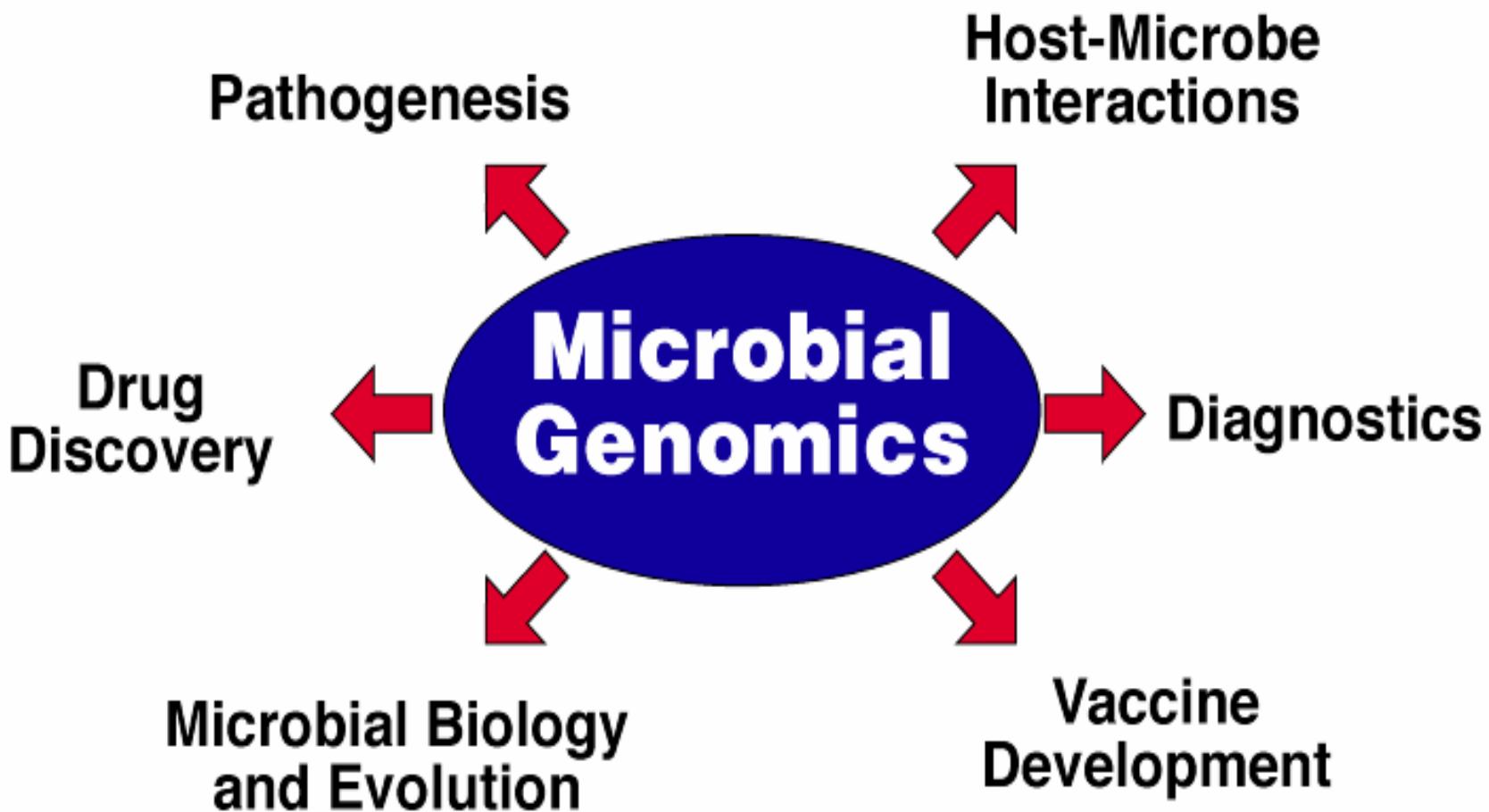
NIAID Genomics Initiatives



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NIH/DHHS
2004

NIAID Genomic/Bioinformatic/Proteomic Program

- Resources and Reagents**
- Genomic Capacity**
- Basic and Applied Research Projects
using Genomic Technologies**



Microbial Sequencing Centers

Genomic Data

**Bioinformatics
Centers**
Data Warehouse
Data Analysis

**PFGRG
Resources
Reagents**

**Proteomic
Centers**
Early Target Ident.
HT-Cloning/Expression

**Population
Genetic
Analysis
Program**

Basic Research

**Early Identification of Targets
Vaccines, Drugs and**

Target Identification

**Diagnostics
Tech.Dev.**

NIAID/DMID Genomics Program

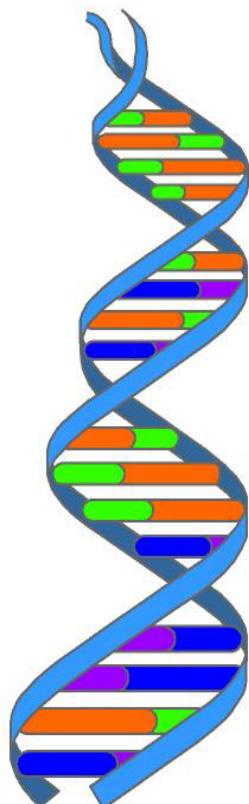
NIAID Microbial Genome Sequencing Centers

Goal:

Rapid and cost-efficient production of high-quality genome sequences of human pathogens and invertebrate vectors of disease.

Features:

- Two Genome Sequencing Centers
 - The Institute for Genomic Research (TIGR)
 - MIT
- Capacity to sequence genomes for:
 - Other government agencies
 - Scientific community
 - Response to national emergencies





Microbial Sequencing Centers

Currently Funded Sequencing Projects

Bacillus anthracis

Burkholderia mallei

Burkholderia pseudomallei &

Bacteriophages

Coronaviruses

Francisella tularensis

Influenza Genome Project

Mycobacteria tuberculosis

Plasmodium vivax

Trichomonas vaginalis

Yersinia pestis

Vibrio cholerae

Aedes aegypti

Culex pipiens

Ixodes scapularis

Microbial Sequencing Centers

Sequencing Projects

- White paper request process
- Community-based sequencing projects
- Sequencing and annotation
- Organizational and management plan developed with MSC, NIAID and scientific community
- Research resource-rapid data release

NIAID Genome Sequencing Projects

55 Completed Projects (Aug. 2004)

- 43 Bacteria
 - 3 Fungi
 - 8 Protozoan Parasites
 - *Cryptosporidium parvum*-animal and human
 - *Entamoeba histolytica*
 - *Leishmania major*
 - *Plasmodium falciparum*
 - *Toxoplasma gondii*
 - *Trypanosoma brucei*
 - *Trypanosoma cruzi*
 - 1 Invertebrate Vector of Disease-*Anopheles gambiae*
- 25 + Ongoing Projects
-

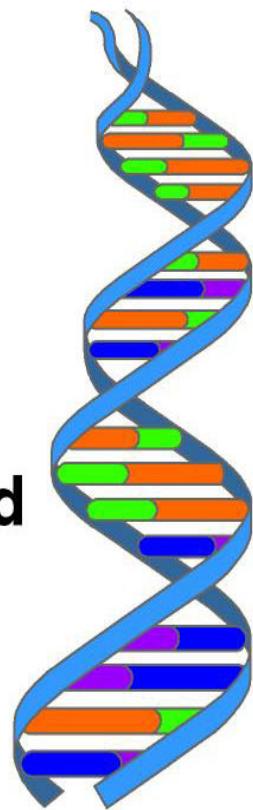
NIAID Pathogen Functional Genomics Resource Center

Goal:

Develop and distribute genomic reagents, resources and technologies for the functional analysis of pathogens and invertebrate vectors of disease.

Genomic Resources:

- Organism-specific microarrays and protocols
- Protein expression clones
- Genotyping/genome analysis
- Development of computational tools for array and comparative genomic data analysis
- Technology development



NIAID Pathogen Functional Genomics Resource Center



Pathogen Functional Genomics Resource Center

Microarrays 2002-2003

Streptococcus pneumoniae
Staphylococcus aureus
Salmonella typhimurium

Chlamydia family
Neisseria gonorrhoeae
Mycobacterium tuberculosis
Plasmodium falciparum

Test arrays with probes

Microarrays 2003-2004

Bacillus anthracis
Clostridium botulinum
Listeria monocytogenes
Yersinia pestis
Vibrio cholerae

Human SARS Chip
Coronaviruses

Aspergillus fumigatus
Group B Streptococcus
Helicobacter pylori
Mycobacterium smegmatis
Porphyromonas gingivalis-NIDCR
Streptococcus mutans-NIDCR
Trypanosoma cruzi
Trypanosoma brucei

Pathogen Functional Genomics Resource Center

Invitrogen Gateway Entry Clones

- **Clone sets:**
 - *Streptococcus pneumonia*
 - *Human SARS coronavirus*
 - *Bacillus anthracis*
 - *Mycobacterium tuberculosis*
 - *Yersinia pestis*

- **Custom Clone Sets for select organisms**

<http://www.niaid.nih.gov/dmid/genomes/pfgrc/default.htm>

Pathogen Functional Genomics Resource Center

Comprehensive Genomic Analysis of *Bacillus anthracis*

- Collaboration with TIGR/NIAID/P.Keim/NSF
- *Bacillus anthracis* Genomes Sequenced
 - **Kruger B** GT87, B1 12X
 - **Western North America** GT3 A1a 12X
 - **France CNEVA 9066** GT79 B2 12X
 - **Ancestor, Ames (NSF)** GT62, A3b Closed
 - **Vollum A4088** GT77, A4 12X
 - **Aussie 94** A0039 Group A 12X
 - **A01055** Group C 12X
- *Bacillus cereus* Genomes Sequenced
 - ***B.cereus*-10987** 12X
 - ***B.cereus*-CDC clinical isolate** 12X
- Affymetrix Discovery Chip/Genotyping Tool
- Bioinformatics Software Development

Pathogen Functional Genomics Resource Center

Additional Functional Genomics Projects

- Comprehensive Genomic Analysis of *Yersinia pestis*
- Resequencing chip-*Streptococcus pneumoniae* and *Francisella tularensis*
- Proteomic Technology Development and proteome analysis of *Yersinia pestis* and *Staphylococcus aureus*
- Protein Array Development
- Expression of Microbial Proteins

Bioinformatics Resource Centers

Goal: Provide the scientific community with a robust point of entry for access of genomic and related data in a user-friendly format.

Components:

- Database
 - Genomic and Related Data
- Analysis Center
 - Develop and Provide Software Tools
- Multi-disciplinary Team
 - Bioinformatics and Database Experts
 - Biologists and Domain Experts

Bioinformatics Resource Centers

- **The Institute for Genomic Research**
PI: Dr. Owen White
Category A priority pathogens: *Bacillus anthracis*, *Clostridium botulinum*, *Francisella tularensis*
Category B priority pathogens: *Burkholderia mallei*, *Burkholderia pseudomallei*, *Clostridium perfringens*
- **University of Pennsylvania; University of Georgia**
PI: Dr. David Roos, U-Penn
Category B priority pathogens: Apicomplexa species: *Toxoplasma gondii*, *Cryptosporidium parvum*
Category C priority pathogens: Apicomplexa species: *Plasmodium* phylum
- **University of Notre Dame (UND); European Bioinformatics Institute; European Molecular Biology Laboratory; Institute of Molecular Biology and Biotechnology; Harvard University; Purdue University; University of California Riverside**
PI: Dr. Frank Collins, UND
Category C priority pathogens: Invertebrate vectors of human pathogens: *Anopheles gambiae*, *Aedes aegypti*, *An. funestus*, *Culex pipiens*, *Ixodes scapularis*
- **SRA International; University of Wisconsin Madison**
PI: Dr. John Greene, SRA
[Enteropathogen Resource Integration Center \(ERIC\) Web Site](#)
Category A priority pathogen: *Yersinia pestis*
Category B priority pathogen: Diarrheagenic *E. coli*, *Yersinia enterocolitica*, *Shigella*, *Salmonella*
- **Virginia Bioinformatics Institute (VBI); Loyola University Medical Center; Social and Scientific Systems; University of Maryland**
PI: Dr. Bruno Sobral, VBI
Category B priority pathogens: *Rickettsiae* species, *Brucella* species, *Coxiella burnetii*, Calicivirus, Hepatitis A virus
Category C priority pathogens: Rabies virus, Coronavirus
- **University of Alabama Birmingham (UAB); University of Victoria, Canada**
PI: Dr. Elliot Lefkowitz, UAB
[Poxvirus Bioinformatics Resource Center Web Site](#)
Category A priority pathogens: *Variola major* virus, Arenaviruses, Hanta virus, Rift Valley fever virus, Ebola virus, Marburg virus, Dengue virus
Category B priority pathogens: California encephalitis group virus, Kyasanur forest disease virus, Omsk hemorrhagic fever virus, West Nile virus, Alphavirus
Category C priority pathogens: Hantaan virus, Puumala virus, Crimean-Congo hemorrhagic fever virus, Yellow fever virus, Tick-borne encephalitis, Nipah virus, Equine morbillivirus
- **Northrop Grumman; University of Texas Southwestern Medical Center (UTSMC); Vecna Technologies; Amar International**
PI: Dr. Richard Scheuermann, UTSMC
Category B priority pathogens: *Giardia lamblia*, *Entamoeba histolytica*, *Microsporidia*, *Ricinus communis*
Category C priority pathogens: Multi-drug resistant *Mycobacterium tuberculosis*, Influenza virus
- **University of Chicago (UC); Fellowship for Interpretation of Genomes; University of Illinois Urbana-Champaign**
PI: Mr. Rick Stevens, UC
Category B priority pathogens: *Staphylococcus aureus*, pathogenic vibrios, *Listeria monocytogenes*, *Campylobacter jejuni*
Category C priority pathogens: *Streptococcus pyogenes*, *Streptococcus pneumoniae*



NIAID

Proteomics Research Centers

Goal:

Characterize the pathogen and/or host cell proteome, identifying proteins associated with biology of microbes, mechanisms of microbial pathogenesis, and host response to infection.

Discover targets for potential candidates for the next generation of vaccines, therapeutics, and diagnostics.

Proteomic Technology Development

Proteomics Research Centers

- **Albert Einstein College of Medicine**
PI: Dr. George Orr
Category B priority pathogens: *Toxoplasma gondii*, *Cryptosporidium parvum*
- **Myriad Genetics, Inc; SUNY, Stonybrook; University of California, Los Angeles; Robarts Research Institute**
PI: Dr. Karen Heichman (Myriad Genetics)
Category A priority pathogens: *Bacillus anthracis*, *Yersinia pestis*, *Francisella tularensis*, *vaccinia*
- **The Scripps Research Institute; Burnham Institute; Palo Alto Research Center**
PI: Dr. Peter Kuhn (Scripps)
Emerging/Re-Emerging Infectious Disease: SARS CoV
- **University of Michigan; The Scripps Research Institute**
PI: Dr. Phillip Hanna (U. Michigan)
Category A priority pathogen: *Bacillus anthracis*
- **Harvard Medical School; Massachusetts General Hospital**
PI: Dr. Joshua LaBaer (HSM)
Category A priority pathogen: *Bacillus anthracis*
Category B priority pathogen: *Vibrio cholerae*
- **Caprion Pharmaceuticals, Inc.; University of Montreal**
PI: Dr. Eustache Paramithiotis (CPI)
Category B priority pathogen: *Brucella abortus*
- **Social and Scientific Systems, Inc. (SSS); Virginia Bioinformatics Institute; Georgetown University**
PI: Ms. Margaret Moore (SSS)
Administrative Resource Center

<http://www.niaid.nih.gov/dmid/genomes/prc/default.htm>



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Viral Infections

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Introduction

In 1995, the first microbe sequencing project, *Haemophilus influenzae* (a bacterium causing upper respiratory infection) was completed with a speed that stunned scientists.

Encouraged by the success of that initial effort, researchers have continued to sequence an astonishing array of other medically important microbes. NIAID has made significant investments in large-scale sequencing projects and includes projects to sequence the complete genomes of many pathogens, including the bacteria that cause tuberculosis, gonorrhea, chlamydia and cholera and organisms that are considered agents of bioterrorism. In addition, NIAID collaborates with other funding agencies to sequence larger genomes of protozoan pathogens such as the organism causing malaria.

[Proteomics Research Centers](#)

[Bioinformatics Resource Centers](#)

[Invitrogen Gateway® Entry Clones](#)
now available

[New microarrays combine *Plasmodium falciparum* and *Anopheles gambiae* genomes on one chip](#)

[Microbial Sequencing Centers](#)

[NIAID Offers "SARS Chip" Free to Researchers](#)

[Pathogen Functional Genomics Resource Center](#)

For more information about Pathogen Genomics research, contact:
[Dr. Maria Y. Giovanni](#)